CAI-150 Multi-Functional Calculator DIY Kit

1.Introduction:

CAI-150 is Multi-Functional Calculator Electronic Soldering DIY Kit. It is powered by two CR2032 button batteries, integrates five different computing functions, and uses a traditional LCD1602 display screen to display the calculation process and results in real-time.

It can not only be used as a DIY electronic welding kit that allows you to better understand the circuit and learn how to soldering, but also as a very suitable experimental workbench tool.

2.Feature:

1>.Basic Arithmetic Calculator
2>.4-Color or 5-Color Ring Resistance Calculator
3>.Calculate the working series resistor for LED
4>.Decimal to Hexadecimal
5>.Hexadecimal to Decimal
6>.Arithmetic Square Root Calculator
7>.Classic LCD1602 LCD Display Screen
8>.4*5 Transparent Matrix Keyboard
9>.Automatic power off without operation within 30 seconds
10>.DIY Hand Soldering

3.Parameter:

1>.Work voltage: DC 6V
2>.Display Color: Blue/White Screen
3>.Power Type: CR2032*2 Battery
13>.Work Temperature:-40℃~85℃
14>.Work Humidity:5%~95%RH
15>.Size(Installed):126*86*36mm

4.Use Methods:

1>.Function-1: Basic Decimal Arithmetic Calculator with decimal point and minus sign.
E.g: Calculate the result of ‘ 5*6 ’. Steps:
1.1>.Press ‘ON’ button to power ON.
1.2>.Press the buttons ‘ 5 ’, ‘ * ’, ‘ 6 ’and ‘ = ’ in sequence.
1.3>.Automatically Calculate and display Results 30
1.4>.Press ‘AC’ button can be cleared to zero.
E.g: Calculate the result of ‘ -8+2 ’. Steps:
1.1>.Press ‘ON’ button to power ON.
1.2>.Press the buttons ‘ - ’, ‘ 8 ’, ‘ + ’, ‘ 2 ’and ‘ = ’ in sequence.
1.3>.Automatically Calculate and display Results - 6
1.4>.Press ‘AC’ button can be cleared to zero.

2>.Function-2: 4-Color or 5-Color Ring Resistance Calculator. Input the color of the metal film resistor surface in sequence, then you can get resistor’s resistance value and error value.
E.g: 5-Color Ring Resistor within Yellow,Violet,Black,Brown,Brown. Steps:
2.1>.Press ‘ON’ button to power ON.
2.2>.Press ‘MODE’ button to switch to ‘Color Ring R C 5’ display interface.
2.3>.Press the buttons ‘Yellow’, ‘Violet’, ‘Black’, ‘Brown’ and ‘Brown’ in sequence.
2.4>.Automatically Calculate and display Results resistance value 4700ohm and error value 1%
2.5>.Press ‘AC’ button can be cleared to zero.
E.g: 4-Color Ring Resistor within Green,Red,Yellow,Gold. Steps:
2.1>.Press ‘ON’ button to power ON.
2.2>.Press ‘MODE’ button to switch to ‘Color Ring R C 5’ display interface.
2.3>.Press ‘√’ button to switch to ‘Color Ring R C 4’ display interface.
2.4>.Press the buttons ‘Green’, ‘Red’, ‘Yellow’, and ‘Gold’ in sequence.
2.5>.Automatically Calculate and display Results resistance value 520Kohm and error value 5%
2.6>.Press ‘AC’ button can be cleared to zero.
Note: Operation error if display ‘error’.

3>.Function-3:Calculate Series Resistor for LED.

Note: The following parameters need to be known: Circuit Work Voltage, LED Work Voltage, LED Work Current, Then you can calculate and obtain the series resistance value.

Calculate Formula: R=U/I=(Vi-Vd)/I.

Vi is the Circuit Work Voltage.

Vd is the LED Work Voltage.

I is the LED Work Current.

R is the series resistor.

E.g: Circuit Work Voltage Vi is 5V, LED Work Voltage Vd is 3V, LED Work Current I is10mA. So the resistor's work voltage is Vi-Vd=5V-3V=2V. Steps:

3.1>.Press 'ON' button to power ON.

3.2>.Press 'MODE' button to switch to 'Rled Vi-Vi= V I= mA R= ' display interface.

3.3>.Press '√' button to input LED Work Current.

3.4>.Press the buttons ' 1 ', ' 0 ' and ' = ' in sequence.

3.5>.Automatically Calculate and display Results resistance value 200ohm.

3.6>.Press 'AC' button can be cleared to zero.

4>.Function-4:Decimal to Hexadecimal and Hexadecimal to Decimal.

E.g: Decimal to Hexadecimal. Steps:

4.1>.Press 'ON' button to power ON.

4.2>.Press 'MODE' button to switch to '10HEX-16HEX' display interface.

4.3>.Input Decimal value and then can get a Hexadecimal value automatically.

4.4>.Press 'AC' button can be cleared to zero.

E.g: Hexadecimal to Decimal. Steps:

4.1>.Press 'ON' button to power ON.

4.2>.Press 'MODE' button to switch to '10HEX-16HEX' display interface.

4.3>.Press '√' button to switch to '16HEX-10HEX' display interface.

4.4>.Input Hexadecimal value and then can get a Decimal value automatically.

4.5>.Press 'AC' button can be cleared to zero.

5>.Function-5: Arithmetic Square Root Calculator.

E.g: Calculate the value of '√4'. Steps:

5.1>.Press 'ON' button to power ON and display Basic Decimal Arithmetic Calculator.

5.2>.Press '√' button to switch to '√0' display interface at.

5.3>.Press the buttons ' 4 ', and ' = ' in sequence.

5.4>.Automatically Calculate and display Results resistance value 2.

5.5>.Press 'AC' button can be cleared to zero.

6>.CR2032 Battery: It is powered by two RC2032 batteries. Due to limited battery capacity, frequent use or prolonged standby may result in low battery power and inability to function properly. Please replace the batteries promptly.

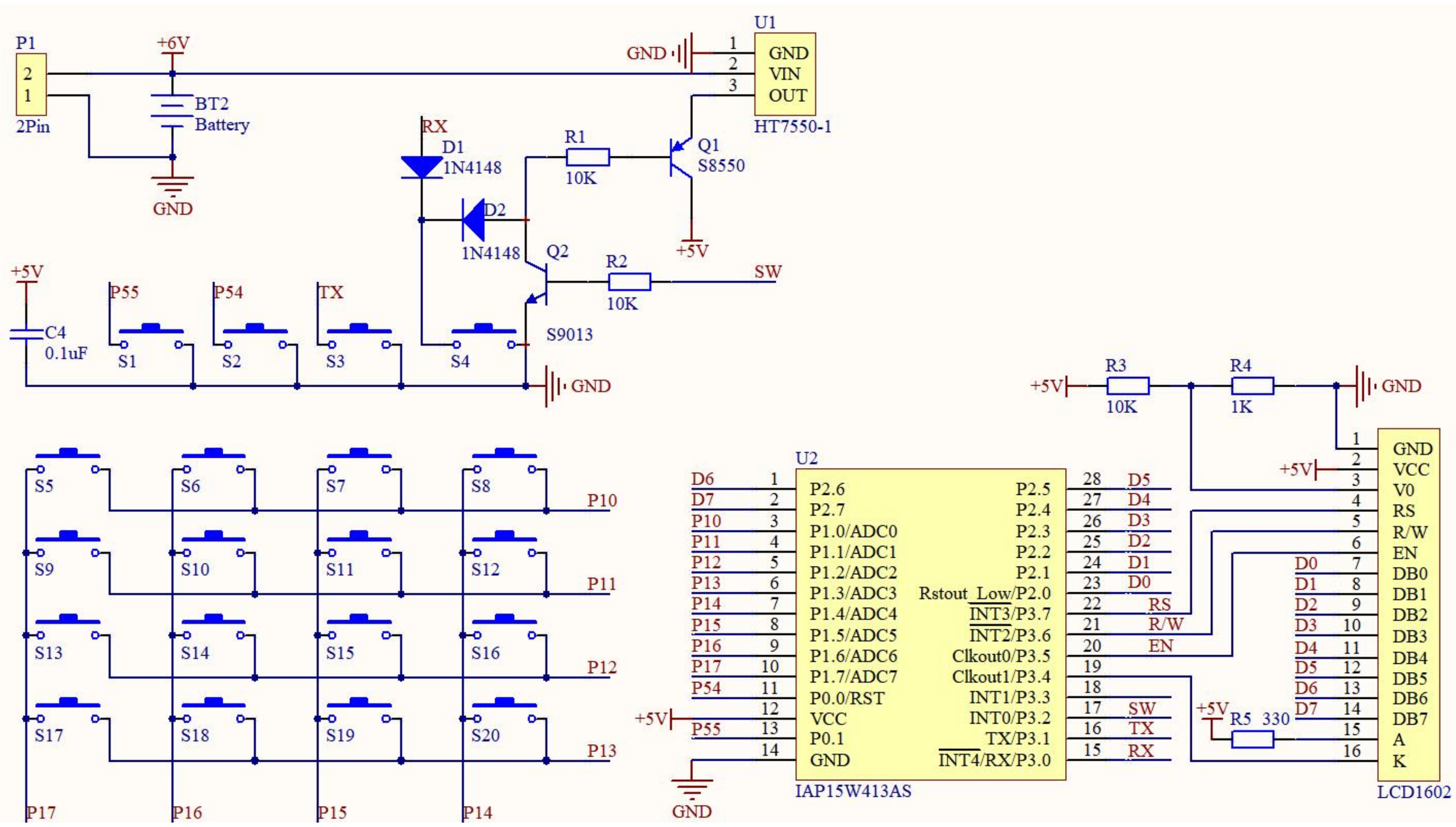
7>.Automatic shutdown: Automatic power off without operation within 30 seconds.

5.Component Listing:

NO.	Component Name	PCB Marker	Parameter	QTY
1	IN4148 Diode	D1,D2	DO-35	2
2	Metal Film Resistor	R5	330ohm	1
3	Metal Film Resistor	R4	1Kohm	1
4	Metal Film Resistor	R1,R2,R3	10Kohm	3
5	16Pin Male Pin	LCD1602	19mm	1
6	16Pin Female Pin	LCD1602		1
7	Ceramic Capacitor	C4	0.1uF 104	1
8	7550A-1 Voltage Regulator	U1	TO-92	1
9	S8550 Transistor	Q1	TO-92	1
10	S9013 Transistor	Q2	TO-92	1
11	IAP15W413AS	U2	DIP-28	1
12	IC Socket	U2	DIP-28	1
13	CR2032 Battery Socket	BT2		2

14	CR2032 Battery	BT2	3V	2
15	Black Button	S1-S20	12*12mm	20
16	Blue Button Cap	S1-S20		20
17	Transparent Button Cap	S1-S20		20
18	Self Tapping Screw		8mm	4
19	Self Tapping Screw		7mm	8
20	LCD1602 Display Module	LCD1602		1
21	Black Shell			2
22	PCB Circuit Board		220*68mm	1
Note:Users can complete the installation according to the PCB silk screen and component list.				

6.Schematic Diagram:



7.Application:

1>.Training welding skills
2>.Student school
3>.DIY production
4>.Project Design
5>.Electronic competition
6>.Gift giving
7>.Crafts collection
8>.Home decoration
9>.Souvenir collection
10>.Graduation design
11>.Holiday gifts

8.Installation Tips:

1>.User needs to prepare the welding tool at first.
  1.1>.Soldering iron (<50 Watt)

1.2>.Rosin core ("radio") solder
1.3>.Wire cutters
1.4>.Wire strippers
1.5>.Screwdriver
2>.Please be patient until the installation is complete.
3>.The package is DIY kit.It need finish install by user.
4>.The soldering iron can't touch the components for a long time(1.0 second), otherwise it will damage the components.
5>.Pay attention to the positive and negative of the components.
6>.Strictly prohibit short circuit.
7>.User must install the LED according to the specified rules.Otherwise some LED will not light.
8>.Install complex components preferentially.
9>.Make sure all components are in right direction and right place.
10>.It is strongly recommended to read the installation manual before starting installation!!!
11>.Please wear anti-static gloves or anti-static wristbands when installing electronic components.

9.Installation Steps(Please be patient install!!!):

Buttons Descriptions	
MODE	Mode Button: Switch Function Mode.
√ / ⇕	Switch Button: 1.Switch Basic Arithmetic and Arithmetic Square Root at Calculator Mode. 2.Switch Input Voltage and Current at Calculate Series Resistor for LED Mode. 3.Switch 4-Color or 5-Color Ring Resistor at Calculate Resistor Value. 4.Switch Decimal <=> Hexadecimal at Decimal/Hexadecimal Mode.
←	Delete Button: 1.Clear input values in sequence.
ON / AC	Power/Clear Button: 1.Power Switch. Note: Automatic power off without operation within 30s 2.Clear result or clear input parameter value.
0 Black	Numeric Button: 1.The 1st line is numerical value and be used for calculator. 2.The 2nd line is color/value and be used tor calculate resistor value.
= B	Hexadecimal Button: 1.Red uppercase letters A, B, C, D, E, F in the lower right corner of each buttons. 2.It's used for input Hexadecimal value by 0~9 and A~F buttons.
Notes:	
1.It is powered by two RC2032 batteries. Due to limited battery capacity, frequent use or prolonged standby may result in low battery power and inability to function properly. Please replace the batteries promptly. 2.Automatic power off without operation within 30 seconds. 3.Correctly place the position and direction of components to avoid poor contact caused by virtual soldering.	

Funtion 1: Basic Decimal Arithmetic Calculator with decimal point and minus sign.

E.g: Calculate 5*6=30



Steps: Press【ON】button to starting up, then press【5】,【X】,【6】,【=】in turns.
Get results = 30. Press【AC】button to clear.

E.g: Calculate -8+2=-6



Steps: Press【ON】button to starting up, press【-】,【8】,【+】,【2】,【=】in turns.
Get results = - 6. Press【AC】button to clear.

Funtion 2: 4-Color or 5-Color Ring Resistance Calculator.Input color in turn to get resistor value.

E.g: 5-Color Ring Resistor: Yellow,Violet,Black,Brown,Brown, Value is 4700Ω

Steps: Press【ON】button to starting up, press【MODE】to switch to 'Color Ring R C 5' display interface.
Then press【Yellow】,【Violet】,【Black】,【Brown】,【Brown】in turns.
Get resisitor value 4700Ω and error value 1%. Press【AC】button to clear.



E.g: 4-Color Ring Resistor: Green,Red,Yellow,Gold, Value is 520KΩ

Steps: At 'Color Ring R C 5' display interface,press【⬍】to switch to 'Color Ring R C 4' display interface.
Then press【Green】,【Red】,【Yellow】,【Gold】buttons in turns.
Get resisitor value 520KΩ and error value 5%. Press【AC】button to clear.



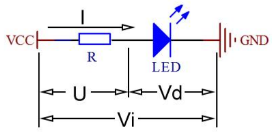
Note: Operation error if display 'error'.

Function-3: Calculate Series Resistor for LED.

Note: Circuit Work Voltage, LED Work Voltage, LED Work Current need to be known.

Calculate Formula: R=U/I=(Vi-Vd)/I

Vi : Circuit Work Voltage
Vd : LED Work Voltage
I: LED Work Current
R: Series resistor



E.g: Circuit Work Voltage Vi is 5V, LED Work Voltage Vd is 3V, LED Work Current I is10mA.
So the resistor's work voltage U is Vi-Vd=5V-3V=2V.



Steps: Press【ON】button to starting up, then press【MODE】button to switch display 'Rled Vi-Vi= V I= mA R=' interface.
Press【2】as Vi-Vd=2V.
Press【⬍】switch to input LED Work Current. Then press【1】,【0】buttons in turns as LED work current 10mA.
Press【=】button at last.
Get serives resisitor value 200Ω. Press【AC】button to clear.

Funtion 4: Decimal to Hexadecimal and Hexadecimal to Decimal.

E.g: Decimal 26 to Hexadecimal 1A



Steps: Press【ON】button to starting up, press【MODE】to switch to '10HEX-16HEX' display interface. Then press【2】,【6】buttons in turns.
Get results hexadecimal value 1A automatically. Press【AC】button to clear.

E.g: Hexadecimal D5A to Decimal 3418



Steps: At '10HEX-16HEX' display interface, press【⬍】to switch to '16HEX-10HEX' display interface.Then press【D】,【5】,【A】buttons in turns.
Get results decimal value 3418 automatically. Press【AC】button to clear.

Funtion 5: Arithmetic Square Root Calculator.

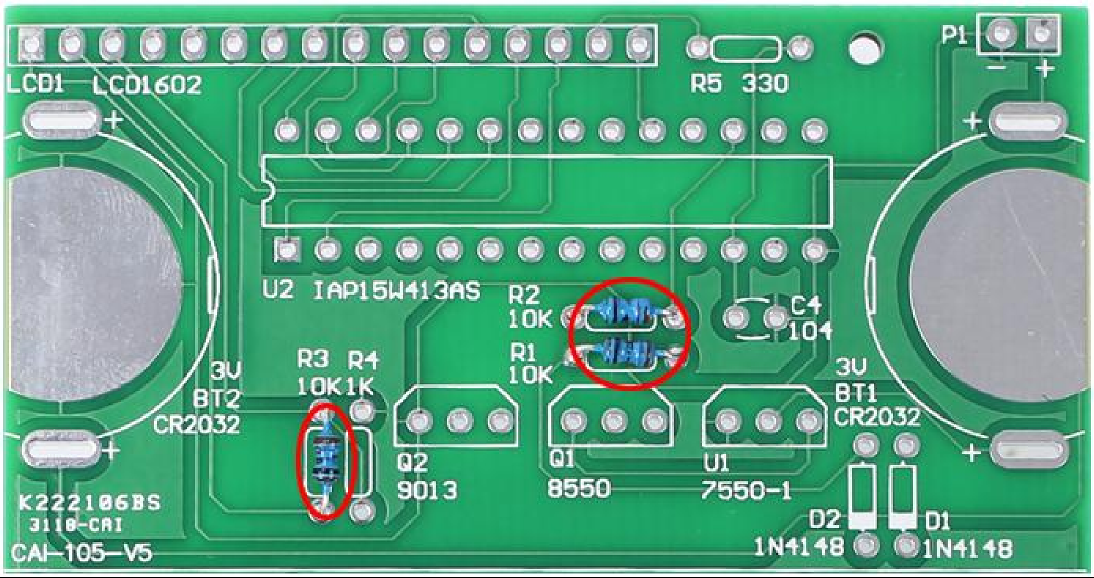
E.g: $\sqrt{4}$ = 2



Steps: At Basic Decimal Arithmetic Calculator display interface, press【⬍】button to switch to '√ 0' display interface.Then press【4】,【=】buttons in turns.
Get results 2. Press【AC】button to clear.

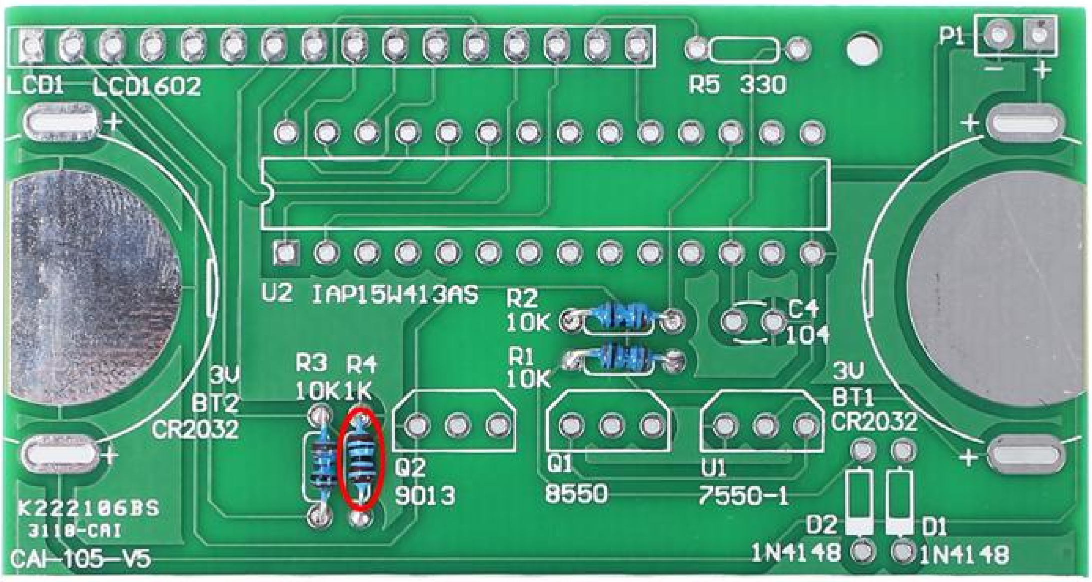
Step 1: Install 3pcs 10Kohm Metal Film Resistor at R1,R2,R3.





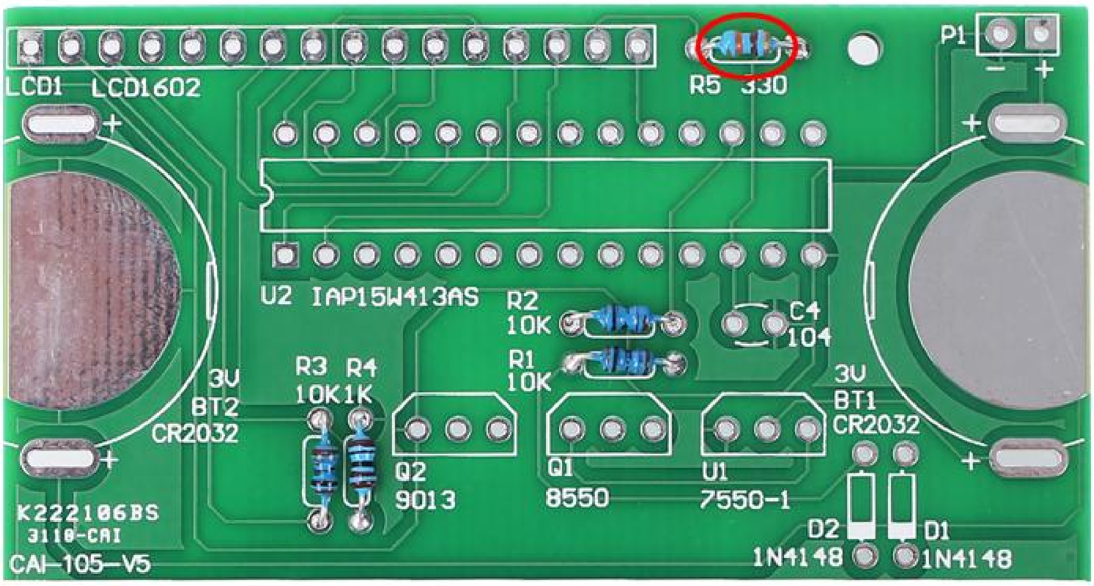
Step 2: Install 1pcs 1Kohm Metal Film Resistor at R4.



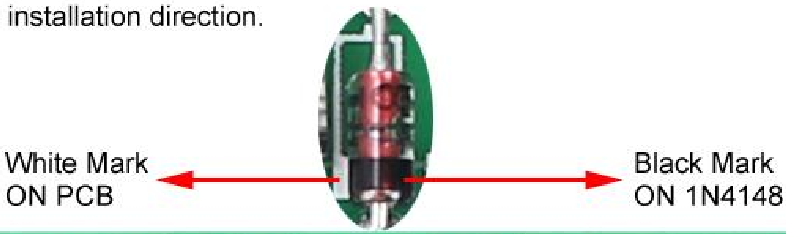


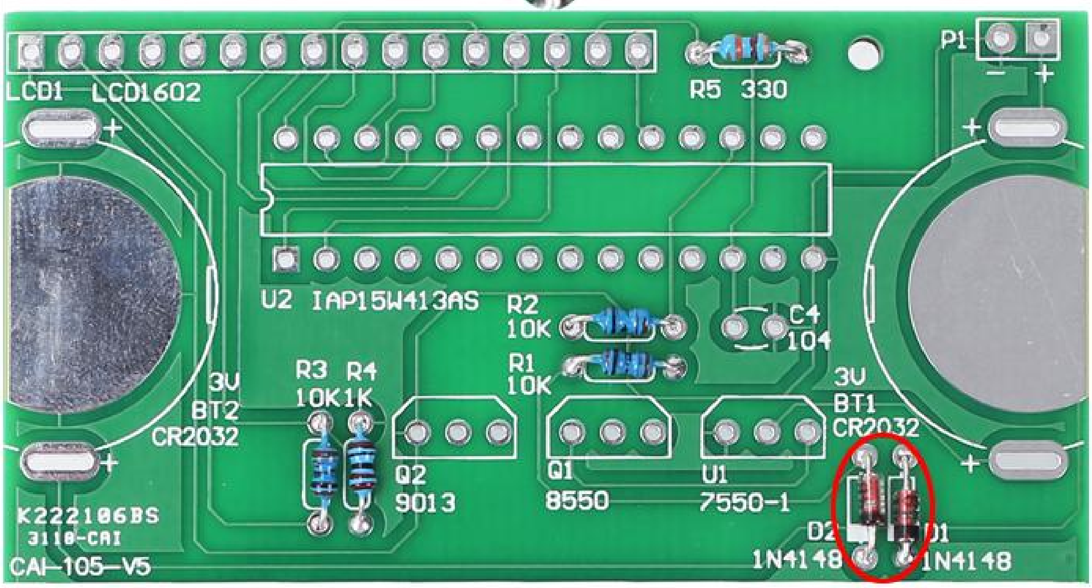
Step 3: Install 1pcs 330ohm Metal Film Resistor at R5.



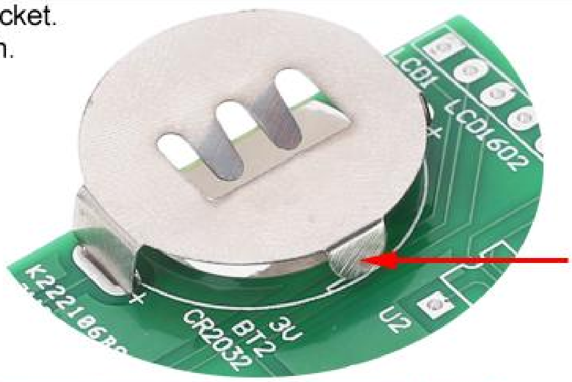


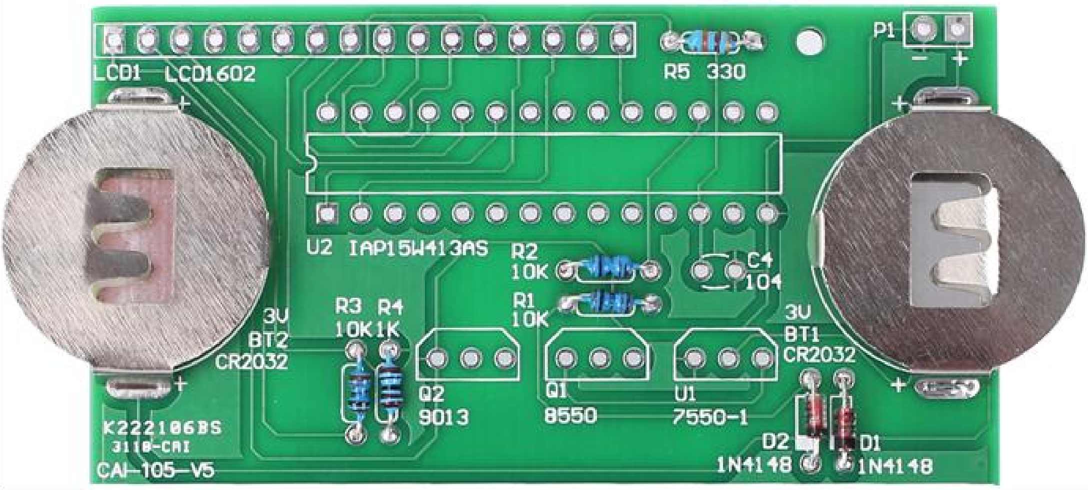
Step 4: Install 2pcs DO-35 1N4148 Diode at D1,D2. Pay attention to the installation direction. There is a black mark on 1N4148 and a white mark on PCB which are used to confirm the installation direction.



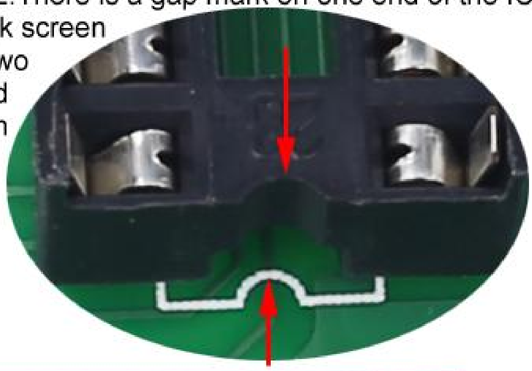


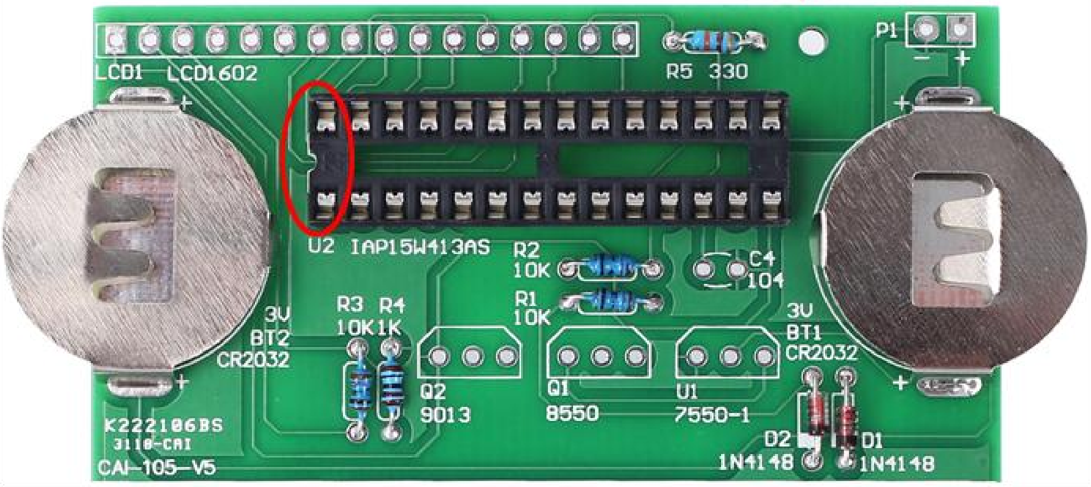
Step 5: Install 2pcs CR2032 Battery Socket.
Pay attention to the installation direction.



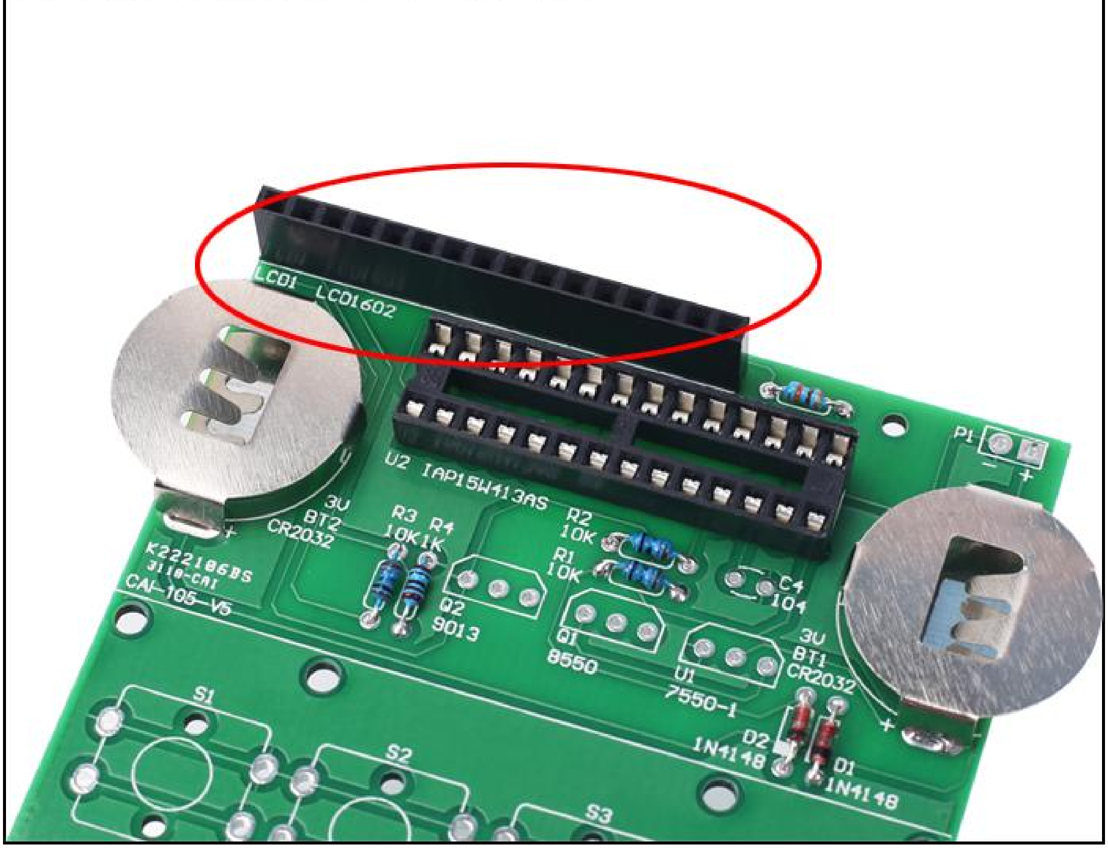


Step 6: Install 1pcs DIP-28 IC Socket at U2.There is a gap mark on one end of the IC Socket and there is a gap mark on PCB silk screen where the IC Socket can place on.These two marks are corresponding to each other and are used to specify the installation direction of the IC Socket.

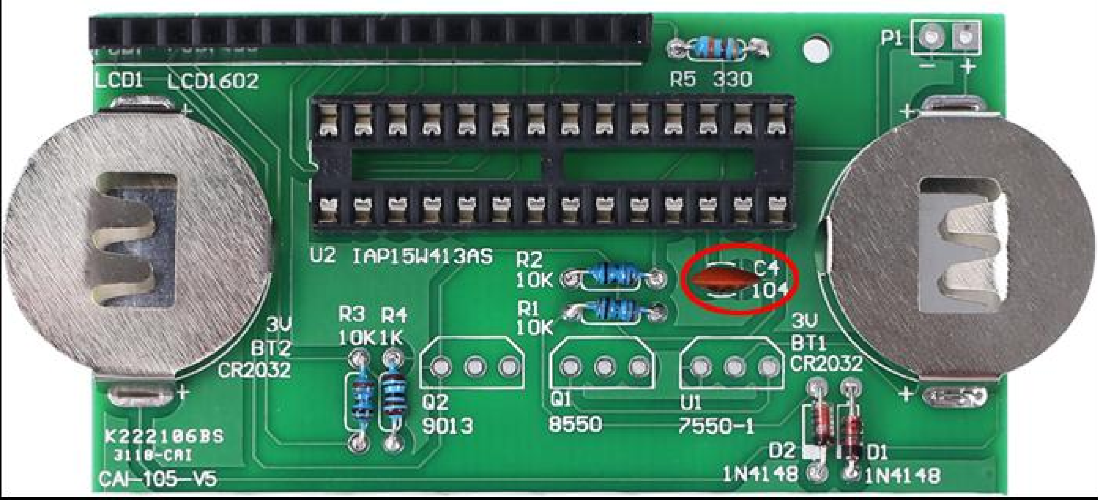




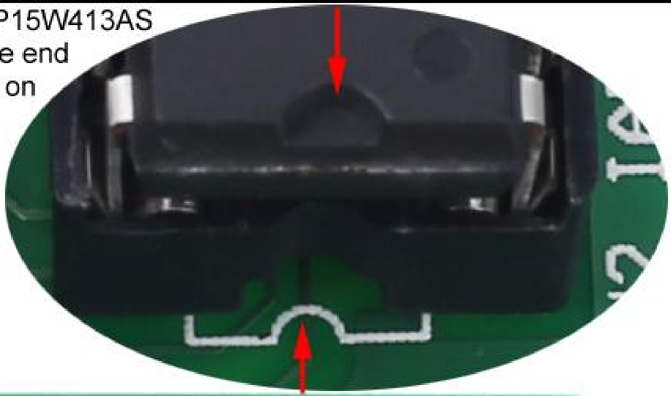
Step 7: Install 1pcs 16Pin Female Pin at LCD1.

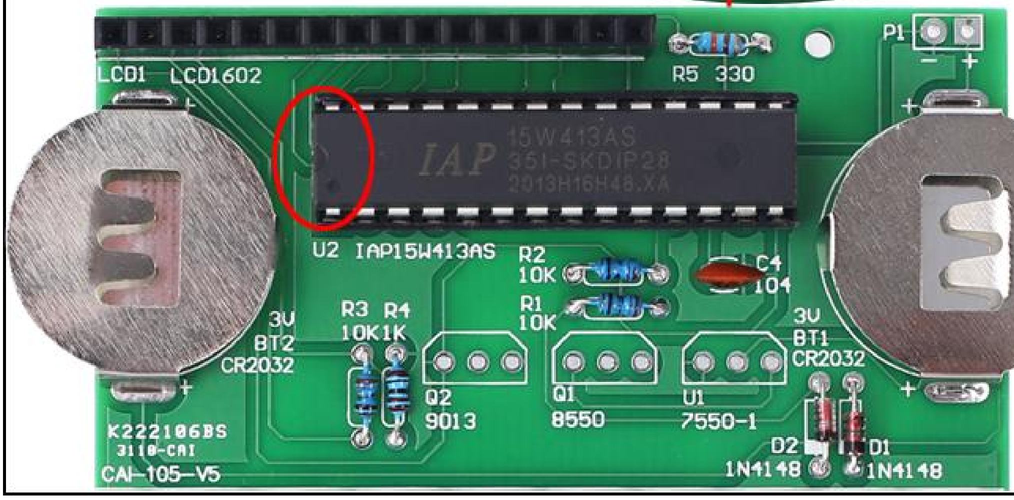


Step 8: Install 1pcs 0.1uF 104 Ceramic Capacitor at C4.



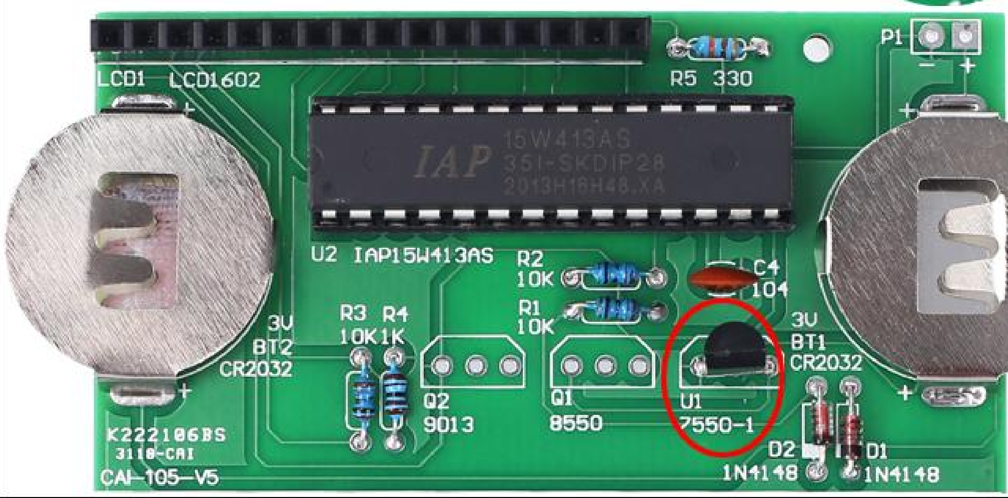
Step 9: Install 1pcs DIP-28 IC IAP15W413AS at U2. There is a gap mark on one end of the IC and there is a gap mark on DIP-28 IC Socket where the IC can place on.These two marks are corresponding to each other and are used to specify the installation direction of the IC.





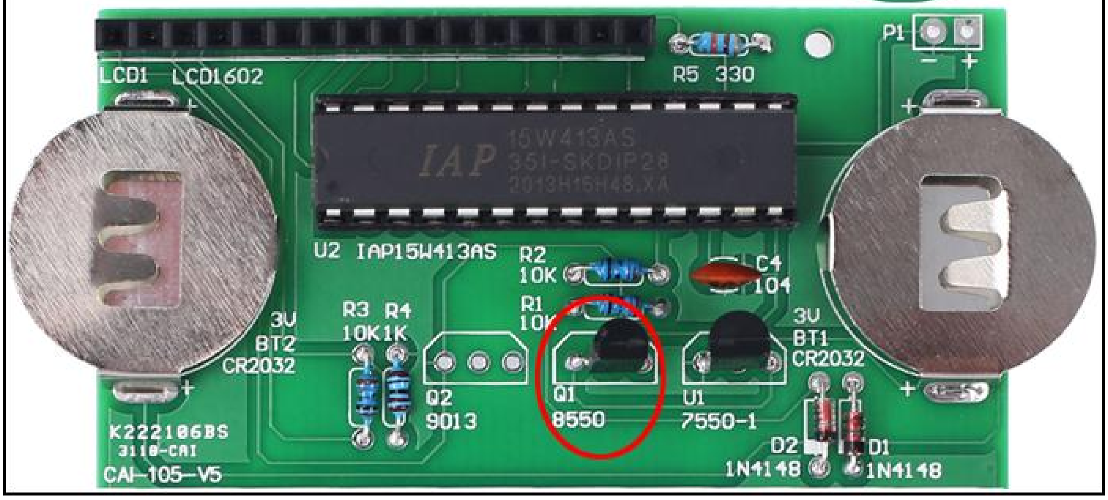
Step 10: Install 1pcs TO-92 7550A-1 Voltage Regulator at U1. Pay attention to the installation direction. The arc on the PCB corresponds to the arc of the components.





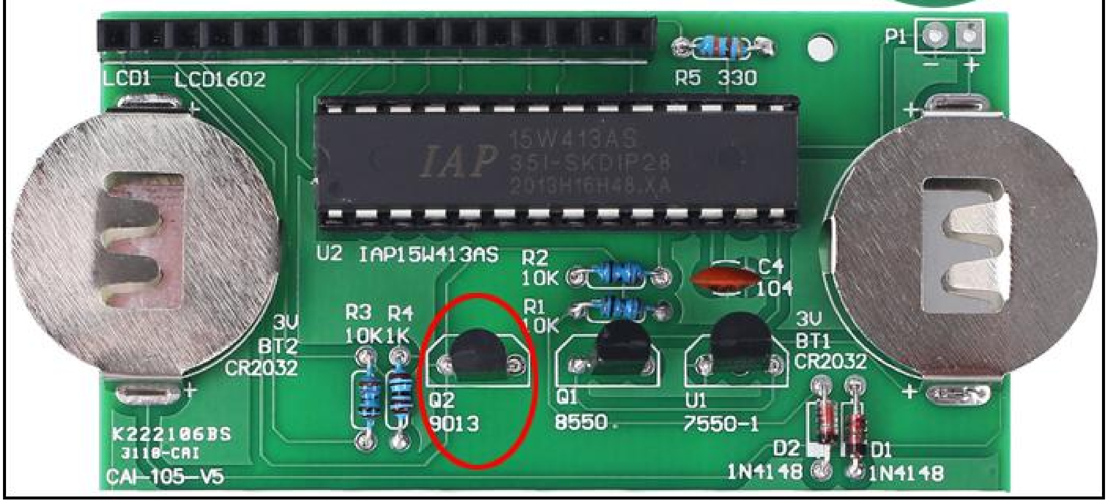
Step 11: Install 1pcs TO-92 S8550 Transistor at Q1.
Pay attention to the installation direction.
The arc on the PCB corresponds to the arc of the components.





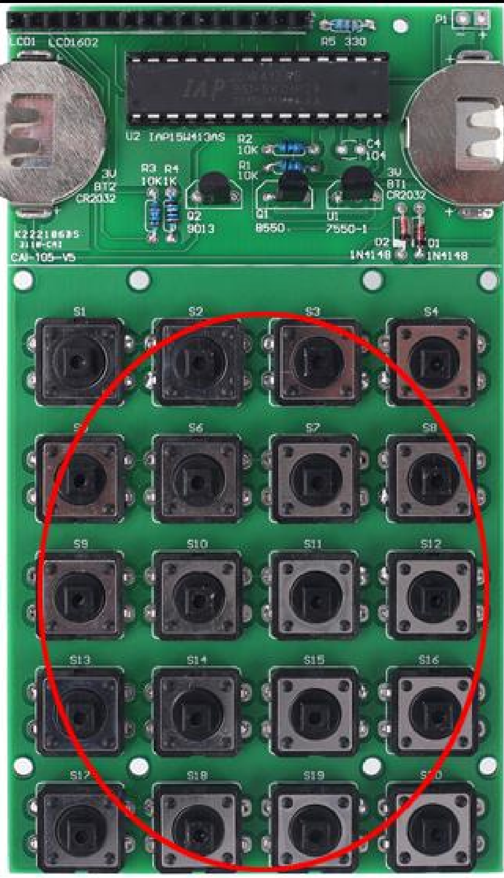
Step 12: Install 1pcs TO-92 S9013 Transistor at Q2. Pay attention to the installation direction. The arc on the PCB corresponds to the arc of the components.



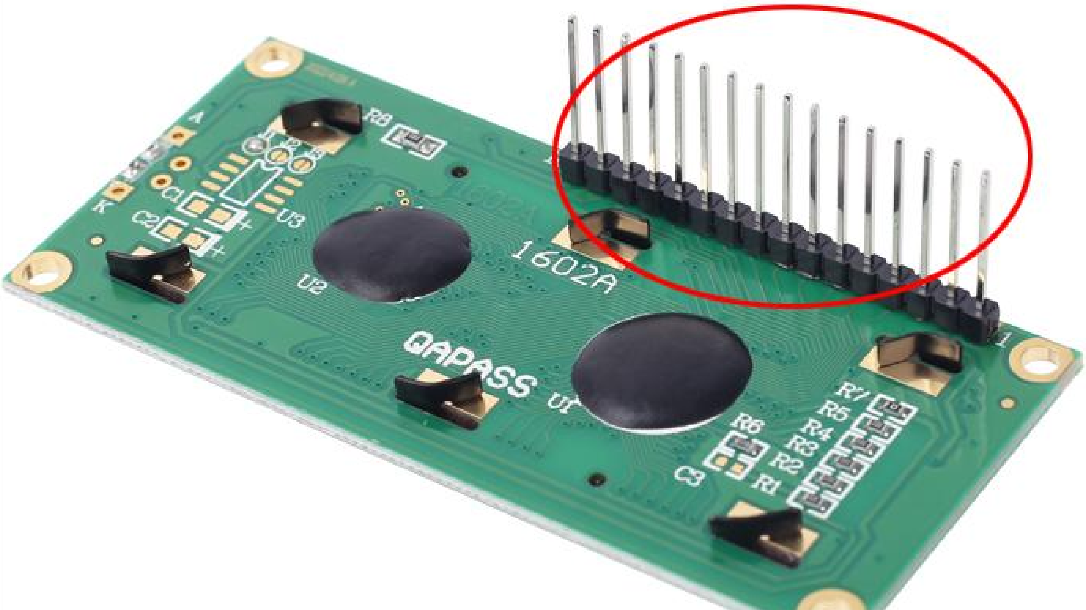


Step 13: Install 20pcs 12*12mm Black Button at S1-S20.

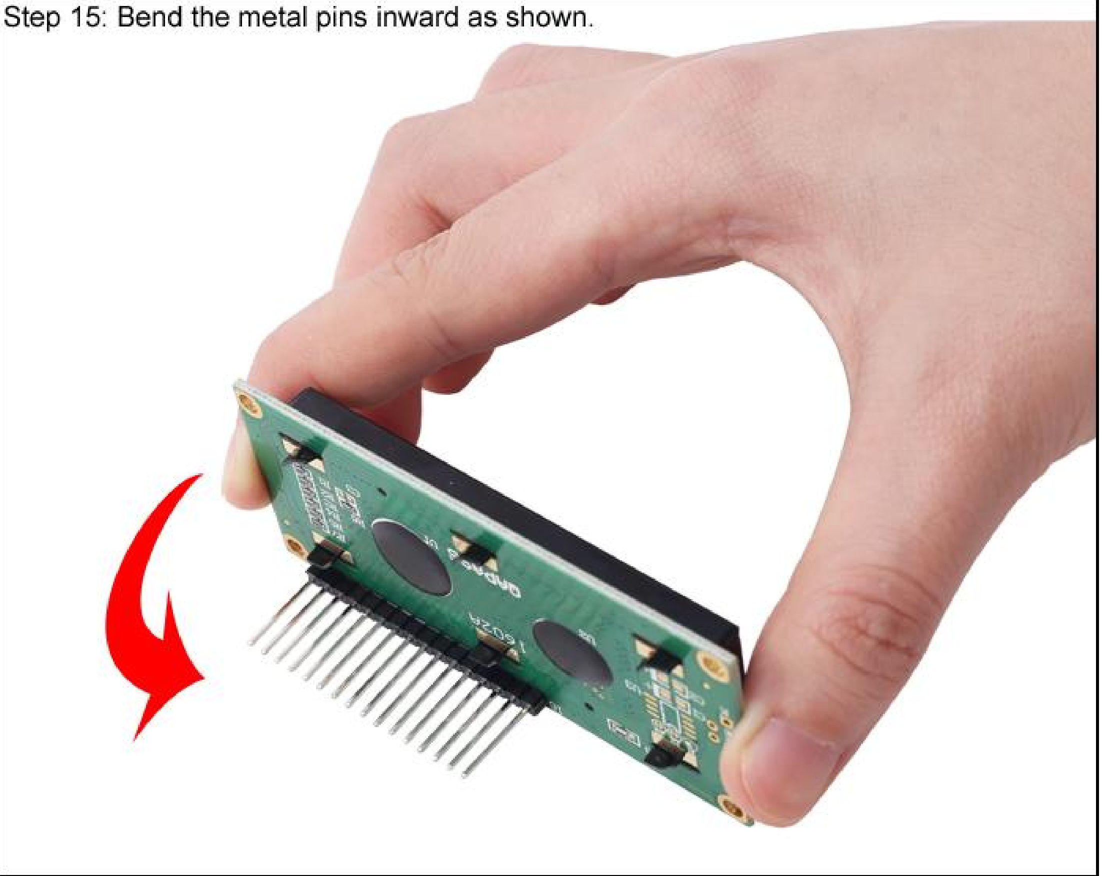




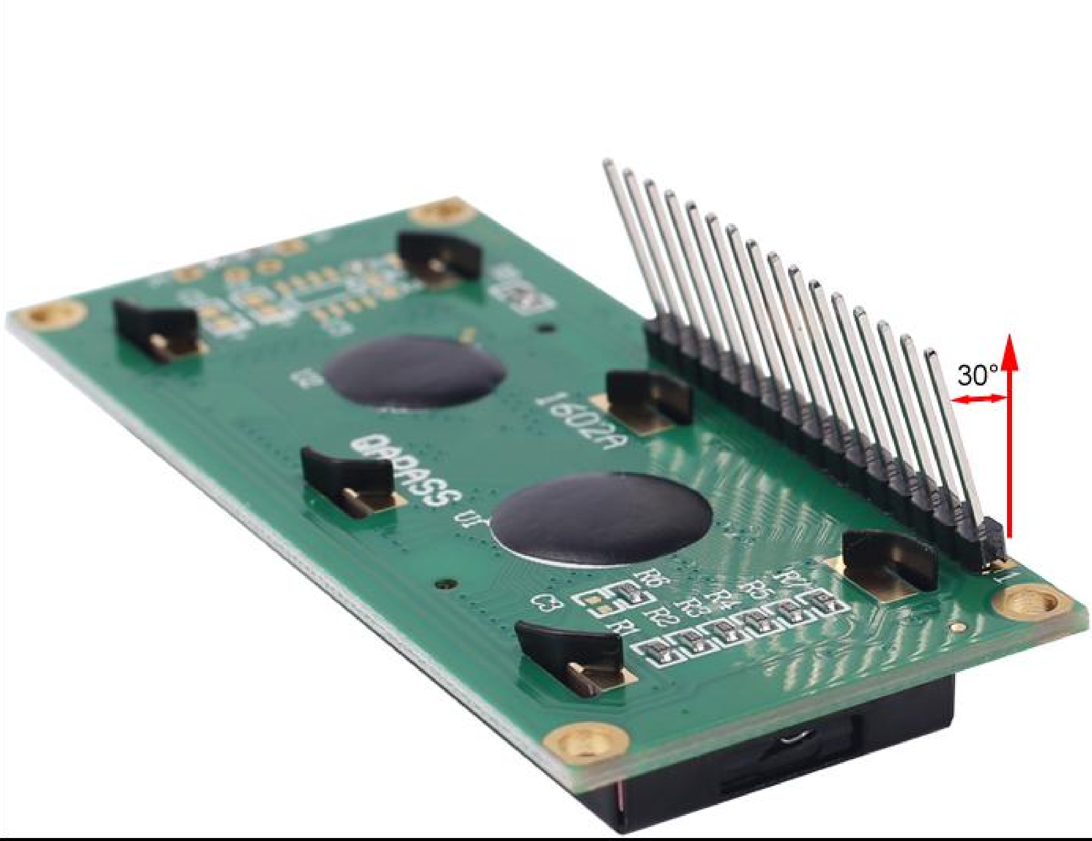
Step 14: Install 1pcs 16Pin Male Pin on the back side of LCD1602.



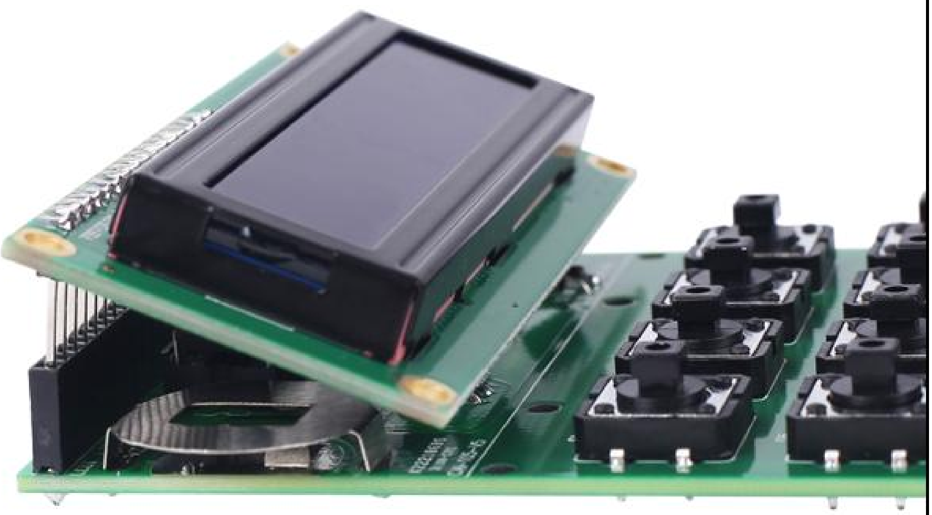
Step 15: Bend the metal pins inward as shown.



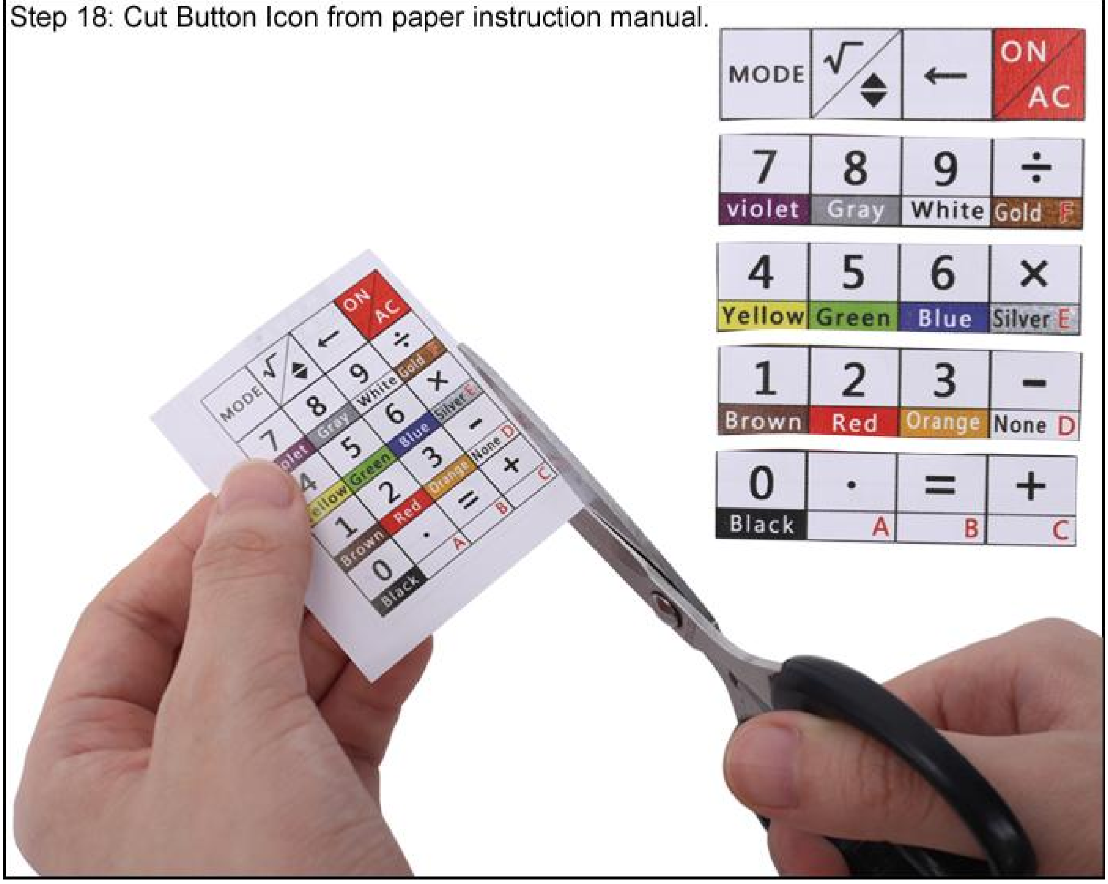
Step 16: Ensure that the angle of pin bending is around 30°



Step 17: Insert LCD1602 display screen into the 16Pin Female Socket.

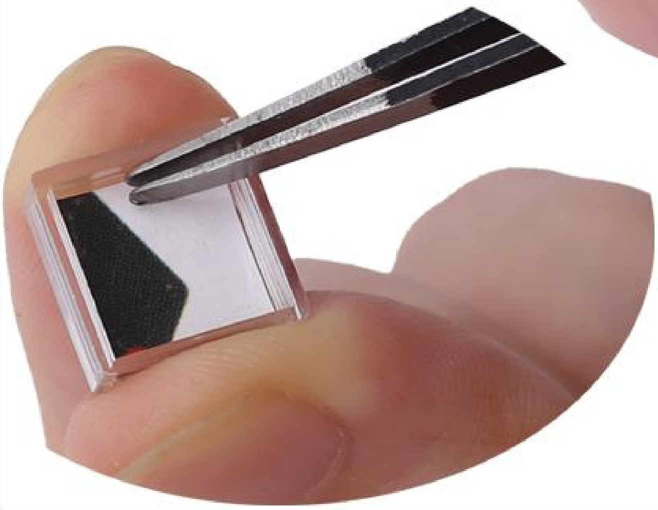


Step 18: Cut Button Icon from paper instruction manual.



Step 19: Place the button icon in the transparent button cap. It can be inserted faster and more conveniently with the help of tweezers.





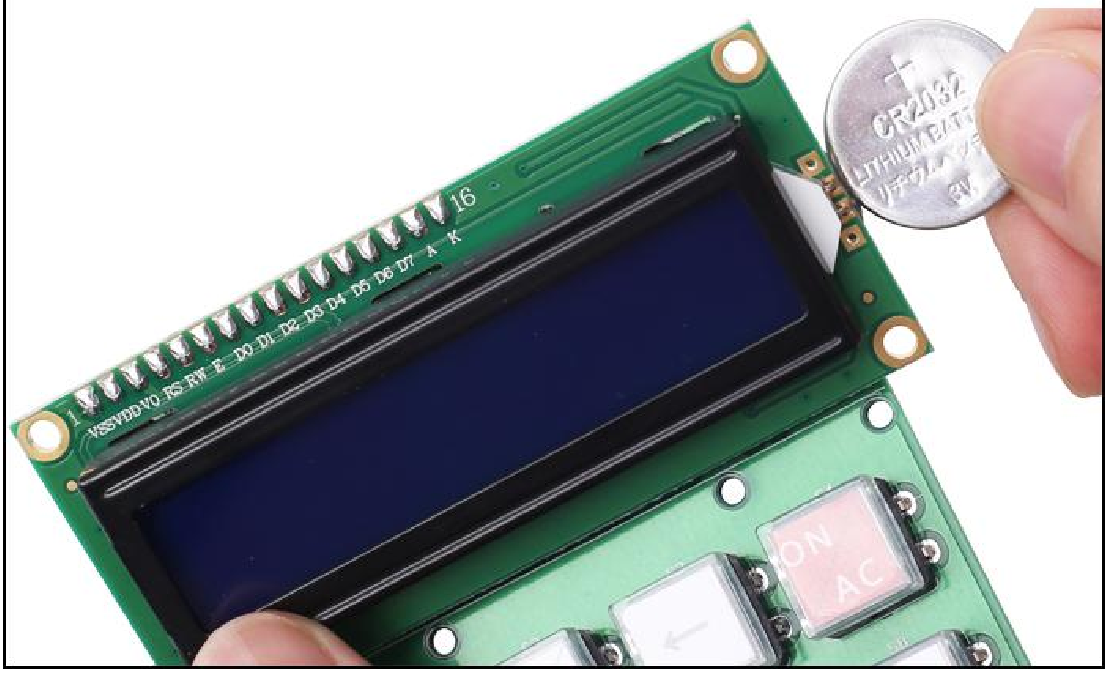
Step 20: Insert the blue button cap into the transparent button cap.

Step 21: Install the blue button cap on Black Button as shown.
Be sure to place buttons with different icons in the specified positions.





Step 22: Install 2pcs CR2032 batteries as shown. Note: The positive electrode of the battery contacts the metal spring of the battery holder.



Step 23: Place PCB on TOP case and adjusting the position of the buttons.

Note:Please patiently align the installation holes of each button and LCD1602.

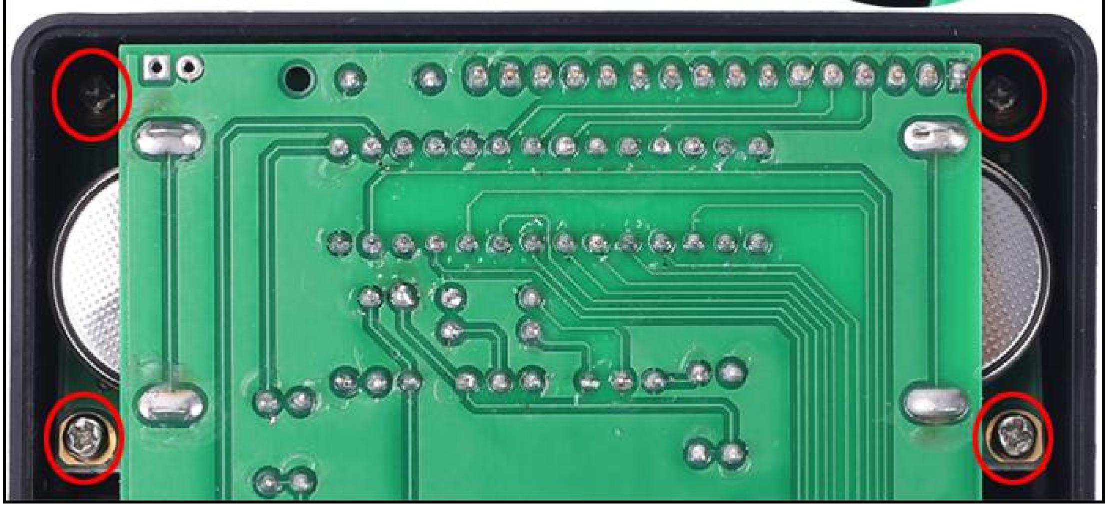


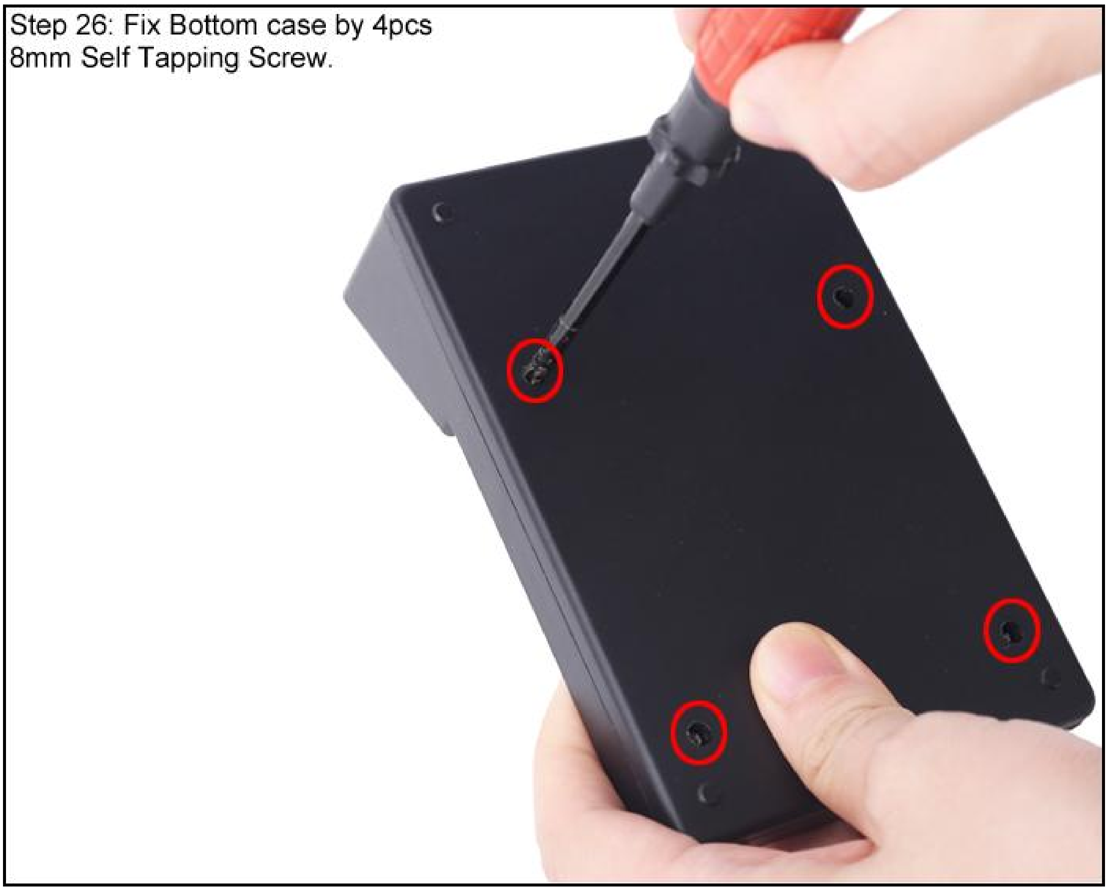
Step 24: Fix PCB by 4pcs 7mm Self Tapping Screw.



Step 25: Fix LCD1602 Display Screen by 4pcs 7mm Self Tapping Screw.
It can be inserted faster and more conveniently with the help of tweezers.







Step 26: Fix Bottom case by 4pcs
8mm Self Tapping Screw.